Space & Naval Warfare Systems Command / PEO C4I & Space

Navy Extremely Low Frequency Communications System Facilities Closure (September 2004)

ELF COMMUNICATIONS SYSTEM BACKGROUND

The ELF Communications System was used by the Fleet to send short, highly formatted messages to submarines operating at speed and depth. The transmitters for this system are located at Clam Lake, Wisc., and Republic, Mich. The antennas and grounds are on land open to public use in the Chequamegon National Forest in Wisconsin and on State Forest lands in Michigan. The annual operating cost for the two facilities was $13 million.

The ELF system became operational in 1989. The two sites operated simultaneously to meet worldwide coverage requirements. Each antenna looks like a power line, mounted on wooden poles. The Wisconsin antenna consists of two lines, each about 14 miles long. The Michigan antenna uses three lines, two about 14 miles long and one about 28 miles long. Each site has a transmitter building near the antenna. The transmitter facility in Michigan uses about six acres of land and the one in Wisconsin about two acres.

REPUBLIC ELF TRANSMITTER FACILITY

Naval Radio Transmitter Facility Republic is located in the Upper Peninsula of Michigan within the Escanaba State Forest and the Copper Country State Forest, approximately 25 miles southwest of Marquette and approximately 17 miles west of Gwinn, Mich. The antenna system consists of one 28-mile north-south antenna, one 13-mile east-west and one 15-mile east-west antenna, totaling 56 miles of overhead pole lines with underground crossings at some roads and streams. In addition, there are approximately 38 miles of overhead or buried ground lines. The system consists of approximately 833 wooden poles and six terminal grounds with a total of 44 grounding wells.

CLAM LAKE ELF TRANSMITTER FACILITY

The Clam Lake facility is located in the Chequamegon National Forest, Wisc., under a memorandum of understanding with the U.S. Forest Service. It operates in conjunction with a similar site 148 miles east in Republic, Mich., to provide ELF communication connectivity with the Navy's submarines deployed worldwide. The facility consists of the antenna, resembling overhead power lines running in two legs of about 14 miles each (on a 75-foot wide right-of-way) and a fenced, two-acre transmitter complex.

NAVY ELF STAKEHOLDERS

- **The Space and Naval Warfare Systems Command** is responsible for mitigation and review, acquisitions, upgrades and public safety for the ELF sites.

- **The Submarine Integration Program Office, PEO C4I & Space,** is responsible for developing operational communications capabilities for submarine forces.
- **SPAWAR Systems Center Charleston** provides engineering and technical support.
- **Naval Network and Space Operations Command, Naval Network Warfare Command,** operates and maintains the Navy's global telecommunications, information and space systems and services in direct support of Fleet, allied and coalition operations, and is responsible for planning and distribution of facility / maintenance funds.
- **Naval Undersea Warfare Center, Naval Sea Systems Command,** provides technical design and development direction, including contract facilitation.
- **The Naval Computer and Telecommunications Area Master Station Atlantic** is responsible for operating the ELF sites in Wisconsin and Michigan.
- **Naval Facilities Engineering Command, Southern Division** is the Navy's real estate agent and responsible for land use permits, easements and land ownership related to the ELF sites.
- **Commander, Submarine Force U.S. Atlantic Fleet / Commander, Submarine Force U.S. Pacific Fleet** operate and maintain combat ready nuclear-powered strategic deterrent and attack submarines.

Naval Undersea Warfare Center / ELF Interference Mitigation
NUWC maintains a contract under which Alion Science and Technology Corporation implements the Navy's ELF mitigation program. This program includes mitigating potential "stray voltage" and other nuisance effects that could affect long wire fences and public utilities in the area. The contractor deals directly with local utility companies whose systems could be affected by the operation of the ELF antenna. The program includes providing the companies with mitigation equipment and paying them to install and maintain this mitigation equipment on their distribution systems.

Since ELF operations terminated Sept. 30, 2004, the Navy and its prime contractor, Alion, have begun working with the local utility companies to determine the best course of de-mitigation action as it applies to the individual utilities.

Naval Computer and Telecommunications Area Master Station, Atlantic / ELF Operations
NCTAMSLANT maintained a contract with Manufacturing Technology, Inc. (MTI) of Ft. Walton Beach, Fla., for operation and maintenance of the transmit segment of the ELF Shore Communication System on a 24 hours per day, seven days per week, 365 days per year basis.

Navy's Government Partners
- **The U.S. Forest Service, Department of Agriculture,** is the owner / trustee of the land at the Wisconsin site (Chequamegon National Forest), and is the owner/trustee of a one fourth mile segment of the land at the Michigan site (Hiawatha National Forest).
- **The Michigan Department of Natural Resources** is the predominant underlying landowner upon which Navy antenna easements at the Michigan site are located (Copper County State Forest, Escanaba River State Forest).

ELF FACILITIES CLOSURE Q&As (SEPT 2004)

Q1: Why was it determined that the ELF capability is no longer necessary?
A1: The Chief of Naval Operations ordered an assessment of the Navy's Fixed Submarine Broadcast System in early 2004. The assessment team, represented by a wide range of Navy authorities, conducted a thorough assessment in the spring and determined that the existing very low frequency (VLF) architecture can provide the

required capability for the submarine force. The decision to close the ELF facilities was based on investing resources into the most critical areas needed by the sea services.

Q2: How was this decision reached?
A2: In the spring of 2004, representatives from a wide range of Navy organizations conducted a thorough assessment of all its Fixed Submarine Broadcast System (FSBS) assets and capability.

The assessment team analyzed the operational capabilities of all fixed submarine VLF (very low frequency), LF (low frequency) and ELF (extremely low frequency) broadcast sites (12 total, worldwide). Specific analysis included:

- Coverage
- Capability
- Availability
- Cost
- Current and future strategic / tactical requirements

FSBS assessment recommended termination of ELF transmitter facilities in Clam Lake, Wisconsin and Republic, Michigan. The ELF mission requirements will be serviced by the VLF architecture.

Q3: What organizations were involved in the assessment?
A3: The assessment team consisted of a wide range of Navy organizations:

- Naval Network Warfare Command (Norfolk, Virginia)
- Office of the Chief of Naval Operations, N61 (Washington DC)
- Commander, Submarine Forces U.S. Atlantic Fleet (Norfolk, Virginia)
- Commander, Submarine Forces U.S. Pacific Fleet (Pearl Harbor, Hawaii)
- Commander, Naval Network and Space Operations Command (Dahlgren, Virginia)
- Program Executive Office for C4I and Space (San Diego, California)
- Johns Hopkins University Applied Physics Laboratory (Laurel, Maryland)

Q4: When was an official decision made?
A4: Public announcement of the closure decision was made Sept. 17, 2004 by Fleet Forces Command, headquartered in Norfolk, Virginia. The system's transmission ceased Sept. 30.

Q5: Did the history of anti-ELF protests and environmental concerns affect the decision?
A5: The decision to close the ELF facilities was an independent, internal Navy decision based on how to best direct resources to the most critical needs facing the sea services today.

Q6: What environmental or health impacts are associated with the operation of the ELF Communications System?
A6:
The EM fields produced by the ELF antenna are similar in nature and strength to those produced by power distribution lines.

Upon the advice of the National Academy of Sciences, the Navy has spent more than $25 million to fund university researchers to investigate the impact of ELF electromagnetic fields from the ELF system on biological

and ecological systems in the vicinity of the ELF transmitters. The results of this research program, which took about 10 years to complete, were reviewed by a committee of the National Research Council (NRC). The NRC's findings were released on 1 July 1997 in a report entitled, *An Evaluation of the U.S. Navy's Extremely Low Frequency Communications System Ecological Monitoring Program*. In its report, the NRC concluded "The committee agrees with the general findings of the Navy's ecological monitoring program, within the limitations described in this report, that the researchers' observations provide no evidence of statistically significant, widespread, adverse effects of EMFs associated with the ELF antennas…"

In 1992, under the Energy Policy Act (Public Law 102-486 Section 2118), congress instructed the Secretary of Energy to establish the Electric and Magnetic Fields Research and Public Information Dissemination (EMF-RAPID) Program to: (1) determine whether or not exposure to electric and magnetic fields produced by the generation, transmission, and use of electric energy affects human health; (2) carry out research, development, and demonstration with respect to technologies to mitigate any adverse human health effects; and, (3) provide for dissemination of information to the public.

The National Institute of Environmental Health Sciences (NIEHS) and the Department of Energy managed the health effects research and evaluation part of this program. EMF-RAPID was a five-year effort jointly funded by federal and matching private funds, with NIEHS receiving $30.1 million. In June 1999, the NIEHS published a report in response to the 1992 *Energy Policy Act*, *'Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields'* (NIEHS Pub No. 99-4493). In this report it states, "The NIEHS believes that the probability that ELF-EMF exposure is truly a health hazard is currently small." Further, the NIEHS believes only, "…passive regulatory action is warranted such as a continued emphasis on educating both the public and regulated community on means aimed at reducing exposures."

Q7: What will the Navy do with the land at the ELF facilities?

A7: The land on which the ELF facilities exist is owned by the U.S. Forest Service in Wisconsin and by the Department of Natural Resources in Republic. The Navy operates under a Memorandum of Understanding with these two government partners. We will work closely with the forest service and Michigan DNR to assess restoration and environmental requirements under the National Environmental Policy Act.

Q8: What is the facilities' closure timeline?

A8: The termination of operations at the ELF sites began Sept. 30, and preparations for site closure began immediately thereafter. Beyond that, there are a number of important areas to be addressed, including the land disposition at the sites, restoration requirements and environmental assessment under the National Environmental Policy Act.

The Navy is working closely with its government partners – the U.S. Forest Service in Wisconsin and the Michigan Department of Natural Resources – to assess restoration and environmental requirements. We anticipate the entire process – from official closure announcement to final disposition – to take up to three years.

Q9: What capabilities did ELF provide?

A9: The ELF communications system allowed submarines operating at depth and speed to use their full range of tactical capabilities and maximize their inherent stealth. This allowed the operational flexibility needed to support command and control requirements.

A10: What do the facilities look like?

A10: The ELF system, which became operational in 1989, uses two transmitting antennas, one in Wisconsin and one in Michigan. The two sites operated simultaneously to meet worldwide coverage requirements. Each antenna looks like a power line, mounted on wooden poles. The Wisconsin antenna consists of two lines, each about 14 miles long. The Michigan antenna uses three lines, two about 14 miles long and one about 28 miles long. Each site has a transmitter building near the antenna. The transmitter facility in Michigan uses about six acres of land and the one in Wisconsin consists of two acres.

The ELF facilities' construction required no relocation of people or buildings. The antenna location in state and national forests to avoid buildings, historic sites, villages and towns. Construction contractors coordinated extensively with the Michigan Department of Natural Resources and the U.S. Forest Services to avoid rare vegetation and to repopulate the easement with local flora.

Q11: What is the clearance required around the antennas?

A12: The ELF antenna in Wisconsin looks like a 14-mile long power line in both the north/south antenna and the east/west antenna. Along the entire length of the antenna is the right-of-way. The right-of-way is 100 feet wide and the Navy maintains it cleared of trees and brush to 37.5 feet either side of the antenna's line. Trees that could potentially fall on the lines are cleared 50 feet either side of the antenna's line.

However, any clearing or disturbance of aesthetic plantings or protected species are coordinated with the U.S. Forest Service. All conditions for removal of trees and brush are in accordance with U.S. Forest Service guidelines. The U.S. Forest service uses the right-of-way in concert with its wildlife management plan to maintain forest open spaces with wildlife. The Elk Introduction Program uses the right-of-way as a prime habitat for this project with outstanding success.

Q14: How does the ELF system work?

A14: The ELF communication system is an above-ground antenna consisting of two "branches." Electrical currents flow from one "branch" through the ground to the other "branch." Flowing back and forth, the currents create oscillating fields.

Since the Clam Lake and Republic sites feature low conductivity rock near the surface, the currents penetrate the ground hundreds of meters before returning to the opposite branch above ground. Since the total length of the ELF antenna (including the long path through the ground) is extensive, the antenna created electromagnetic waves with an extremely low frequency.

The Navy used the ELF waves to contact submarines deep under water, at depths that normal radio waves cannot penetrate. The low frequency, however, is an ineffective radio signal that cannot broadcast much useful information. The Navy used the ELF system as a "bell-ringer" to signal their submarines to come closer to the surface, and then broadcasts the real message by other means.